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PSYCHOLOGICAL LITERATURE.

Methodologische Beiträge zu psychophysischen Messungen, auf experimenteller Grundlage. Von A. WRESCHNER. Schriften der Ges. f. psych. Forschung, Heft 11. Leipzig, J. A. Barth, 1898. pp. vi, 238.

This volume contains the record of an elaborate series of experiments with lifted weights, and of minor series with visual distances and temperatures, together with a detailed discussion of results from the point of view of psychophysical methodology. It is with the weight experiments that we are here chiefly concerned.

(1) *Method.* The experiments fall into two main classes. In the first, 15 standard weights were employed, lying between the limits of 200 and 8,000 gr. Each of these was compared with as many variable weights as sufficed to bring out judgments ranging from "much greater" to "much less." The variables differed from their standard by 0,05 P or some multiple of 0,05 P (P = standard weight). An experimental series ("double series") consisted in the comparison of a given standard weight, twice over, with as many variables as were required for certain judgments of the kind just mentioned: the order of presentation of the variables was determined by lot. Each series was taken in a constant time order (P I = standard first, P II = variable first), and was immediately followed by a second series in the reverse order. On the average, 10 smaller and 10 larger variables were used in every series. The method was without knowledge: we return to the point later. The author served as subject in 12,000 experiments of this kind (20 experiments for each of 20 double series with 15 standards). A control group contains 2,400 experiments.

In experiments of the second class, the standard remained constant at 2,000 gr.; the variables were graded as before. The experiments were not confined, however, to a single lifting of each weight. The first weight of the experiment, standard or variable, according to the time order of the series, was lifted once, twice, thrice, four times or five times; then, the second weight lifted once; and then, the judgment of comparison passed. The author has at his disposal, as principal material, 4,000 experiments (800 of each of the 5 groups). Control groups contain 2,000 and 1,600 experiments respectively.

Experiments were also made with varying interval between lift and lift, each weight being lifted once. The standard was constant at 2,000 gr. (pp. 19, 128).

All experiments were performed with a specially constructed apparatus, in which a padded bracelet pulled up a weighted string over rollers. The position of the elbow was kept constant, and the hand (save for its weight) had no influence on the experiment. The judgments classified were "equal," "less," "greater," "much less," "much greater." Intermediate judgments ("equal or less," "equal or greater," "nearly much less," "nearly much greater,") are regarded by the author as good categories, but played a very small part in actual practice. They are counted with each of the chief judgments upon which they border, and these themselves doubled.

(2) *Evaluation of results.* If P is compared with a series of

(smaller and larger) weights, and these differ but little from term to term of the series, we shall get a number of variables that give the judgment "greater," a number that give "less," and a number that give "equal." The number, in each case, represents the "range" of the judgment in question. By determining the upper and lower limits of range—the variable weight which is "still" or "just" judged so or so—we ascertain its relation to the heaviness of the variable weight, its "quality." If the experiments are numerous enough, we find one variable weight which is most effective to call forth a particular judgment: the opposite of the limiting weights, which are least effective. So, with our variable series for abscissæ, and the number of judgments of a given category for ordinates, we obtain a curve of two branches, rising continuously to and falling continuously from the maximal value (*cf.* Gauss's law of error).

These data must be turned to account in as many ways as possible. In the first place, we notice that the curves show the "reliability" of a judgment under varying conditions. The maximal value of the greater curve, *e. g.*, indicates the variable weight with which the greater judgment is most reliable; its limits indicate those with which the judgment is least reliable. Secondly, we can learn something from them about sensible discrimination. It is clear that sensible discrimination may vary with equal degree of reliability: the maximal value may rest on the same number of confirmatory judgments, but these hold of different variable weights. Sensible discrimination is best represented by the central value, *i. e.*, the arithmetical mean of all judgments of a given category. The central value shows what variable weight has the greatest likelihood of calling out the judgment in question. Thirdly, we can ascertain the clearness or distinctness of the division between the various kinds of judgment by comparing the ascending and descending branches of each curve; the branches of the greater curve, *e. g.*, border on "much greater" and on "equal;" those of the equal curve upon "greater" and "less," etc. Lastly, it is well to fractionate the experiments, first into the two sub-groups P I and P II, and secondly into minor groups according to the date of working (variation of disposition from day to day, course of practice, etc.).

(3) *Mutual relation of the three kinds of judgment, "greater," "equal," "less."* Those who have worked with the method of *r.* and *w.* cases know that several kinds of judgment are possible. Besides the judgments "greater" and "less" there occur the judgments "equal," "equal or greater," "equal or less," and "doubtful." Doubtful cases must be thrown out; they depend upon lapse of attention, upon disturbance by surprise, upon variation in the impression made by the stimulus during its course, etc., etc.¹ The intermediates we have dealt with under (I). The equals have been a source of dispute. Kraepelin, Jastrow, Fullerton and Cattell, Higier, Löwenton require their subjects to make a guess at difference in every experi-

¹ Fechner halved them, distributing half to the greater, and half to the less judgments. *El. d. Psychophysik*, I, 72; but *cf.* G. E. Müller, *Grundl.*, 40 ff. See also Müller and Schumann, *Pfl. Arch.*, XLV, 40; Wreschner, 12. Some writers would distinguish between the judgment "doubtful" (*i. e.*, either equal or different) and the judgment "different" (with doubt whether greater or less). Külpe ascribes the latter to a "reproduction of the general;" the wider concept of "different" is released more quickly than the narrower concepts "greater," etc. *Outlines*, pp. 68, 73, 172 f., etc. But while we may grant this as a law of reproduction, we do not need it for the "different" judgments in the method of *r.* and *w.* cases. Such judgments are probably due to the concurrence of extraneous differences with equality in respect of the attribute under investigation: Meyer, *Zeits.*, XVI, 360. They should, therefore, be thrown out, and the experiment repeated.

ment, so that the judgment of equality is never recorded. Sanford, too, favors the "simpler form" of the method.¹

It is regrettable that difficulties of mathematical treatment should have led to what Ebbinghaus has rightly termed a "Vergewaltigung des Urtheils;" and it is one of the chief merits of the present work, on its methodological side, that it bears out the protest against "simplification" already urged by Merkel, Külpe, Ebbinghaus and Wundt. Dr. Wreschner is able to state definitely, on the basis of the various forms of evaluation given under (2), that "there can be no question but that the judgments 'less,' 'equal,' and 'greater' belong to sharply differentiated (*genau charakterisierte*) judgment categories." His method, which is wider than that of r. and w. cases, allows him to say the same thing of the judgments "much greater" and "much less."

The rest of this section may be summarized as follows: Reliability of judgment is greatest for "less," least for "equal;" sensible discrimination is greatest for "less," least for "greater." Reliability is greater, throughout, in the ascending branch of the curve than it is in the descending; sensible discrimination is greater in the descending branch for "less," in the ascending for "equal" and "greater." "Less" is more clearly distinguished from "equal" than from "much less;" "equal" more clearly from "less" than from "greater;" "greater" more clearly from "equal" than from "much greater." The remainder of the chapter is concerned with the form of the various curves.

(4) *The time error.* The first question to be considered is the question whether the judgments of P II can be reversed ("greater" written as "less," and *vice versa*) to bring them into accord with those of P I. Careful comparison shows that all the characteristics of the two judgment categories, as established under (3), manifest themselves for both time orders, when the reversal of the P II judgments has been made. The psychological reason is that, in the judgments of P II, the memory image of P dominates the subject's mind as soon as P has once been given (second lifting of first experiment)—so that judgments which have the "greater" form are, psychologically, "less" judgments, and *vice versa*. It is always the variable that is judged in relation to the standard, no matter whether standard or variable be given first. Hence any differences between the P I series and the reversed P II series must be put down to the altered time order, and not to differences in the mental mechanism of judgment. We have material for the investigation of the time error.

This analysis is exceedingly important from the point of view of the author's method. Were the subjects told the time order of the first double series or not? Presumably not, since the procedure at large was procedure without knowledge. Suppose, then, that the morning's work begins: chance decides what variables shall be given in the first few experiments. How is the subject to know his standard? There must be a number of initial experiments, varying as the occurrence of mean or extreme variables varies, during which the identification of the standard is impossible. The assumption that these judgments belong to the P I order (in a P I series), and their reversal from the P II to the P I order (in a P II series), cannot be justified. Of course, the knot is cut, if the subjects were acquainted with the time order in every case; but this is nowhere stated.

In either event, a more general criticism may be passed. Is "absolute" judgment in the P II series—judgment of the weight first given in terms of a memory of P, and confirmation by the appearance

¹ Course, pp. 353 ff.

in perception of P itself—is absolute judgment of this kind, which is regarded as a bad experimental habit in the method of r. and w. cases, a form of judgment which it is worth while to introduce in weight experiments by any method? The matter cannot be discussed in detail here. We may, however, note that the part played by the memory image in these experiments must of necessity dispose the author to that psychological theory of the time error which he later adopts.

The results of the chapter are summarized under six heads as follows: 1. The time error has a twofold character; it may be positive (first weight heavier) or negative (second heavier). *a.* Granted a certain degree of practice, it is of greater negative (or lesser positive) value for the smaller variable weights than for the larger: without practice the reverse obtains. *b.* It is positive with the smaller, negative with the larger standard weights. *c.* Continuance of practice changes it (especially with the larger variable weights) in the positive direction. *d.* Fatigue changes it (especially with the larger variables) in the negative direction. *e.* Increase in the distinctness of the memory image of the first lifting changes it in the positive direction. *f.* Within certain limits, increase of time interval between liftings changes it in the negative direction. 2. The magnitude of the time error is variable. *a.* With all variable weights, it is larger, the more remote the variable from the limits and maximum of the judgments “greater” and “less.” *b.* Practice reduces it. *c.* Granted a certain degree of practice, the smaller variables have a larger time error than the larger: without practice the reverse obtains, as it does also under all conditions with small standards. *d.* The time error is smallest with moderate, greatest with very heavy, and moderate with small standards. *e.* In experiments on visual distances and temperatures, the negative value of the time error is less when the standard stimulus is on the left hand side. 3. Sensible discrimination is greater for P II than for P I; “less” is the only exception to the rule. 4. Reliability of judgment is greater for P II than for P I; “less” is, again, the only exception. 5. The time error obtains in very various sense departments (sight, hearing, temperature sense, “muscle” sense). 6. It appears in the two-handed as well as in the single-handed procedure.

It has already been said that the author adopts the psychological (memory image) theory of the time error, as contradistinguished from the physiological (after-effect of first stimulus). He does not, however, deny that fatigue, etc., may have something to say in the matter. The twofold character of the error he explains by the generalizing and schematising tendency of memory, as compared with perception; we have a positive error, a negative error, or no error, according to circumstances.

(5) *Practice.* The theory of practice is considered under the three heads of apprehension of the two weights, estimation of their relation to each other, and retention of the first impression in memory. It is noteworthy, in the latter connection, that the weight first raised appears heavier to the practised than to the unpractised subject: especially is this the case when the variable weight is lifted before the standard. The blurring, weakening effect of memory is thus compensated (pp. 208, 211).

(6) *Weight of the standards.* As was to be expected in an investigation of this kind, there is no direct and unimpeachable evidence of the validity of Weber's law. With constant relative difference between stimuli, it was found that reliability of judgment, sensible discrimination, and separation of the judgment categories improved with increase of absolute weight (limits 200 and 8,000 gr.). On the other hand, the effects of practice and of the time error must not be forgot-

ten; and the author's conclusions square pretty well with those drawn by Fechner (*Elem.*, I, 199) and Müller (*Grdl.*, 225).

Dr. Wreschner may be heartily congratulated on the accomplishment of so thorough and comprehensive a piece of work. The criticisms passed above must be taken as suggestions only; the true test of an experimental enquiry lies in its fruitfulness for further research, and its stability in face of new results.

E. B. TITCHENER.

Etudes d'Histoire de la Philosophie, par E. BOUTROUX. Alcan, 1897.

The first chapter of Mr. Boutroux's "*Etudes*" treats of the conception of History of Philosophy. He does not think that the philosopher as a man ought to be dealt with; nor does he consider the study of special treatises on some topic or other, the object of History of Philosophy. Only in case we find in the writings of a thinker the elements necessary to truly constitute a system of philosophy, need we consider him as forming a part of History of Philosophy.

Two essays, the one on Aristoteles, the other on Kant, are reprinted from the *Grande Encyclopédie*. They bear the mark of such works; they are destined to be read by the public in general, and they therefore contain only the absolutely necessary amount of philosophy; they are of no interest to the specialist.

The study on Boehme is entirely different. With the skill and clearness particular to French thinkers, Boutroux is most successful in extricating the rational element of the thought of Boehme, from the mystical form in which it is enveloped, and he succeeds in presenting a thorough and systematic statement of this philosophy, which is no easy matter. The author points out that the speculations of Boehme are very nearly the same as those of the later German metaphysicians—Leibnitz, Kant, Fichte, Schelling, Hegel, Baader, etc., although he presents them in a different form; and the former fact explains the name of *philosophus tentonicus*, which his friend Dr. Walther justly gives to Boehme. Upon reading Boutroux's work, one has the impression of encountering solid reasoning. And yet it seems to me that he is not entirely right. For not only does one meet with the speculations of Boehme in the works of German metaphysicians, as Boutroux says, but also with metaphysicians of all times and of all countries.

There are but few metaphysical interpretations of the world. They are generally ranged in three classes: pantheism, theism and materialism; and each kind of pantheism has only very few features differing from some other kind of pantheism, just as every kind of theism is akin to other theisms, and one materialism is akin to other materialisms.

Considered in this light, the argument of Boutroux loses a great deal of its value. The only outcome of his reasoning is, that, if the metaphysical speculations of Boehme seem more like those of German thinkers than of thinkers of other countries, it is because German thinkers are more apt than others to devote themselves to metaphysical speculations.

It often happens—and such seems to be the case here—that, in studying the works of a man, we gradually become fascinated by him and consider him more important than he really deserves. This is an error of which Boutroux became guilty, both in treating Boehme and in his examination of the influence of Scotch philosophers on French thought. It cannot be denied that this influence exists; Reid, Dugald Stewart, Brown were thinkers of the same stamp as